Everglades Project - Sedimentation and Erosion

Management Issues:

EFA: The increase in the amount of freshwater delivered to Florida Bay and the changes to water control structures along the coast, as stipulated in the EFA, can change the regional topography which, in turn, can affect saltwater intrusion, vegetation and wildlife.

CERP: The restoration performance measures for marl habitats, mangroves and coastal wildlife, requires an understanding of the processes that allow coastal peat and ridge elevations (sedimentation) to keep pace with subsidence (erosion) and sea level rise.

Project Overview:

Any attempt to forecast the evolution of coastal wetlands must take into account their basic nature as self- regulating, ecological systems (Nuttle, 2000). Self-regulation arises from an ecosystem's ability to respond to outside forces through changes in the ecosystem itself and in its interactions with its environment. Coastal wetlands accumulate sediment by accretion, with the result that they increase in elevation over time relative to stable features of the coast. Processes of accretion, measured relative to local sea level, regulates wetland elevation so that it tracks long-term changes in sea level. When wetland elevation is low relative to sea level, frequent inundation by tides enhances the supply of suspended sediment and nutrients to the wetland. This stimulates accretion by sedimentation. As well, the enhanced nutrient supply supports abundant growth of vegetation, and this contributes to accretion through the production of roots and rhizomes and by trapping suspended sediment for incorporation into new wetland sediment. If the elevation of the wetland increases relative to sea level, tidal inundation becomes less frequent; accretion slows; and the rate at which wetland elevation increases is reduced.

A key to understanding the basic dynamics of coastal wetlands is knowing under what conditions this feedback mechanism fails to operate. As long as accretion is balanced by subsidence, the wetland will tend to maintain its elevation relative to sea level and avoid either submergence or invasion by upland species. The ecosystem cannot maintain itself if accretion is not regulated, and rapid deterioration and loss of the wetland are then possible. Under such so-called "waterlogged" conditions, the productivity of the vegetation is suppressed and accretion is reduced rather than enhanced, which exacerbates the waterlogged conditions further.

Organic matter forms the major structural component of coastal wetland sediments, accounting for over 90% of the sediment volume. Based on the assumption that accretion is controlled by the in situ production of organic matter, the maximum sustainable rate of accretion may be about 16 mm/year, a figure that appears to be comparable to the 20 mm/year upper range estimate of

relative sea level rise. Tide range, freshwater inflows, and available sediment supply affect accretion indirectly through their influences on the soil biochemistry and the growth of the vegetation. Maintenance and recovery of coastal Everglades wetlands is therefore possible only if there is an adequate balance of freshwater and tidal interactions.

Project Objective:

The objective is to evaluate how water management, sea level rise, and regional ecology influence soil elevation changes in the mangrove transition zone of Florida Bay. This is done by creating a simulation and data collection. Data collection has been organized along two transects. An east-west transect , designed to evaluate the structure of the coastal Buttonwood Ridge and a north-south transect, designed to evaluate accretionary processes along a habitat and salinity gradient. At each site the sediment elevation measurements were made using the Boumans and Day (1993) leveling-arm device. This sedimentation-erosion table (**SET**) is a portable arm that is placed into permanent seat pipes, leveled in the horizontal and vertical planes, and from which nine pins are slowly dropped to the sediment surface and measured. The precision of measurements at the 95% confidence interval for the SET technique ranges from ±0.4 mm to ±1.5 mm, depending on substrate characteristics.

Application of Results:

Results will be used in the CERP and the Florida Bay Feasibility Study to fine-tune restoration performance measures for Florida Bay and the transition zone of Everglades National Park. Also, this research will provide a basis for risk assessment models associated with the impacts of global climate change and relative sea level rise.